WHAT IS CLAIMED IS:

1   1.   A method for generating a user interface, wherein an application program

2   processes data and generates application output and wherein a user interface module processes

3   the application output to generate output data to render on an output device, comprising:

4   generating output data, with the user interface module, to render on the output device in

5   response to processing statements in the user interface module;

6   reaching a processing point, with the user interface module, where the user interface

7   module does not include statements to generate output data;

8   receiving, with the user interface module, an interaction object from the application

9   program specifying data after reaching the processing point; and

10   generating output data to render on the output device from the interaction object.

1   2.   The method of claim 1, wherein the interaction object further includes attribute

2   information indicating characteristics of the data to output, wherein the output data is rendered

3   in a format corresponding to the characteristics indicated in the attribute information.

1   3.   The method of claim 1, wherein the user interface module comprises a

2   Controller and View and the application program comprises a Model conforming to the Model

3   View Controller architecture.

1   4.   The method of claim 3, wherein the Controller includes the statements that are

2   processed to generate output data, further comprising:

3   requesting, with the Controller, the interaction object from the Model upon reaching the

4   processing point; and

5   transferring, with the Controller, the received interaction object to the View, wherein

6   the View generates the output data to render from the interaction object.

1   5.   The method of claim 4, wherein the output data generated by the Model

2   includes questions, further comprising:

3   receiving, with the View, user input in response to the presented questions;

4   adding, with the View, the received user input to the interaction object including the

5   output data generated by the View; and

6   returning the interaction object including the received user input to the Model to

7   process.

1   6.   The method of claim 5, wherein returning the interaction object including the

2   received user input to the Model further comprises:

3   transmitting, with the View, the interaction object including the answers to the

4   Controller; and

5   transferring, with the Controller, the Interaction Object including the received user input

6   to the Model.

1   7.   The method of claim 1, wherein multiple user interface modules are capable of

2   generating output data from the interaction object, wherein each user interface module

3   generates the output data to render in a different format.

1   8.   The method of claim 7, wherein each user interface module generates the

2   output data to render on a different type of output device.

1   9.   The method of claim 1, further comprising:

2   continuing to generate, with the user interface module, output data in response to

3   processing statements in the user interface module after the output data generated from the

4   interaction object is rendered on the output device.

1   10.   A method for generating a user interface, wherein an application program

2   processes data and generates application output and wherein a user interface module processes

3   the application output to generate output data to render on an output device by:

4   generating output data to render on the output device in response to processing

5   statements in the user interface module;

6   receiving an interaction object from the application program specifying data to generate

7   as output data;

8   generating output data to render on the output device from the interaction object from

9   the data specified in the interaction object;

10   receiving user input in response to the output data rendered on the output device from

11   the interaction object;

12   adding the received user input into the interaction object; and

13   returning the interaction object including the received user input to the application

14   program.

1   11.   The method of claim 10, wherein the interaction object further specifies

2   attribute information, wherein the output data is rendered on the output device in a format that

3   corresponds to the specified attribute information.

1   12.   The method of claim 10, wherein the interaction object comprises a plurality of

2   interactions, wherein each interaction includes data to cause the user interface module to render

3   a message or question on the output device.

1   13.   The method of claim 12, wherein each interaction is capable of providing

2   information to cause the user interface module to generate a question that is a member of a set

3   of questions comprising:

4   a true false question;

5   an essay question; and

6   a multiple choice question.

1   14.   The method of claim 12, wherein one or more interactions may include data to

2 render a multiple choice question by providing:

3   a question string comprising a question presented to the user;

4   a choice array comprising a plurality of user selectable choices to present as responses

5 to the presented question, wherein the choices in the choice array are presented on the output

6 device with a selection mechanism to enable selection of at least one of the choices; and

7   a selection array indicating which user selectable choices were selected through the

8 selection mechanism, wherein the selection array comprises the received user input in response

9 to the presented question.

1   15.   The method of claim 14, wherein the interaction including data to render a

2 multiple choice question further includes:

3   an allowable selection variable indicating a maximum number of user selectable choices

4 that may be indicated as selected in the selection array.

1   16.   The method of claim 10, wherein the user interface module comprises a

2 Controller and View components and the application program comprises a Model conforming

3 to the Model View Controller architecture.

1   17.   The method of claim 10, wherein multiple user interface modules are capable of

2 generating output data from the interaction object, wherein each user interface module

3 generates the output data to render in a different format.

1   18.   The method of claim 17, wherein each user interface module generates the

2   output data from the interaction object to render on a different type of output device.

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1   19.   A system for generating a user interface on an output device, comprising:

2   a computer readable medium;

3   an application program means for processing data and generating application output;

4   an interaction object included in the computer readable medium specifying data to

5   generate, wherein the application program means generates the interaction object; and

6   a user interface module means for generating output data to render on the output device

7   by performing:

8   (i) processing statements in the user interface module to generate output data to

9   render on the output device;

10   (ii) reaching a processing point where the user interface module does not

11   include statements to generate output data;

12   (iii) receiving an interaction object from the application program specifying data

13   after reaching the processing point; and

14   (iv) generating output data to render on the output device from the interaction

15   object.

1   20.   The system of claim 19, wherein the interaction object further includes attribute

2   information indicating characteristics of the data to output, wherein the user interface module

3   means renders the output data in a format corresponding to the characteristics indicated in the

4   attribute information.

1   21.   The system of claim 19, wherein the user interface module means includes a

2   Controller means and View means and the application program comprises a Model means

3   conforming to the Model View Controller architecture.

1   22.   The system of claim 21, wherein the Controller means includes the statements

2   that are processed to generate output data, wherein the Controller means further performs:

3   requesting the interaction object from the Model upon reaching the processing point;

4   and

5   transferring the received interaction object to the View, wherein the View generates the

6   output data to render from the interaction object.

1   23.   The system of claim 22, wherein the output data generated by the Model means

2   includes questions, wherein the View means further performs:

3   receiving user input in response to the presented questions;

4   adding the received user input to the interaction object including the output data

5   generated by the View; and

6   returning the interaction object including the received user input to the Model to

7   process.

1   24.   The system of claim 23, wherein returning the interaction object including the

2   received user input to the Model is performed by:

3   transmitting, with the View means, the interaction object including the answers to the

4   Controller; and

5   transferring, with the Controller means, the Interaction Object including the received

6   user input to the Model.

1   25.   The system of claim 19, further comprising: multiple user interface module

2   means capable of generating output data from the interaction object, wherein each user

3   interface module means generates the output data to render in a different format.

1   26.   The system of claim 25, wherein each user interface module generates the

2   output data to render on a different type of output device.

1   27.   The system of claim 19, wherein the user interface module means further

2   performs:

3   continuing to generate, with the user interface module, output data in response to

4   processing statements in the user interface module after the output data generated from the

5   interaction object is rendered on the output device.

1   28.   A system for generating a user interface on an output device, comprising:

2   a computer readable medium;

3   an application program means for processing data and generating application output;

4   an interaction object included in the computer readable medium specifying data to

5   generate, wherein the application program means generates the interaction object; and

6   a user interface module means for generating output data to render on the output device

7   by performing:

8   (i) receiving the interaction object specifying data to generate as output data;

9   (i) generating output data to render on the output device from the interaction

10   object from the data specified in the interaction object;

11   (ii) receiving user input in response to the output data rendered on the output

12   device from the interaction object;

13   (iii) adding the received user input into the interaction object; and

14   (iv) returning the interaction object including the received user input to the

15   application program.

1   29.   The system of claim 28, wherein the interaction object further specifies attribute

2   information, wherein the output data is rendered on the output device in a format that

3   corresponds to the specified attribute information.

1   30.   The system of claim 28, wherein the interaction object comprises a plurality of

2   interactions, wherein each interaction includes data to cause the user interface module means to

3   render a message or question on the output device.

1   31.   The system of claim 30, wherein each interaction is capable of providing

2   information to cause the user interface module means to generate a question that is a member of

3   a set of questions comprising:

4   a true false question;

5   an essay question; and

6   a multiple choice question.

1   32.   The system of claim 30, wherein one or more interactions may include data to

2   cause the user interface module means to render a multiple choice question by providing:

3   a question string comprising a question presented to the user;

4   a choice array comprising a plurality of user selectable choices to present as responses

5   to the presented question, wherein the choices in the choice array are presented on the output

6   device with a selection mechanism to enable selection of at least one of the choices; and

7   a selection array indicating which user selectable choices were selected through the

8   selection mechanism, wherein the selection array comprises the received user input in response

9   to the presented question.

1   33.   The system of claim 32, wherein the interaction including data to render a

2   multiple choice question further includes:

3   an allowable selection variable indicating a maximum number of user selectable choices

4   that may be indicated as selected in the selection array.

1   34.   The system of claim 28, wherein the user interface module means comprises a

2   Controller and View components and the application program means comprises a Model

3   conforming to the Model View Controller architecture.

1   35.   The system of claim 28, wherein multiple user interface module means are

2   capable of generating output data from the interaction object, wherein each user interface

3   module means generates the output data to render in a different format.

1   36.   The system of claim 35, wherein each user interface module generates the

2   output data from the interaction object to render on a different type of output device.

1   37.   An article of manufacture including code for generating a user interface, wherein

2   the code includes an application program that processes data and generates application output

3   and a user interface module that processes the application output to generate output data to

4   render on an output device by:

5   generating output data to render on the output device in response to processing

6   statements in the user interface module;

7   reaching a processing point where the user interface module does not include

8   statements to generate output data;

9   receiving an interaction object from the application program specifying data after

10   reaching the processing point; and

11   generating output data to render on the output device from the interaction object.

1   38.   The article of manufacture of claim 37, wherein the interaction object further

2   includes attribute information indicating characteristics of the data to output, wherein the output

3   data is rendered in a format corresponding to the characteristics indicated in the attribute

4   information.

1   39.   The article of manufacture of claim 37, wherein the user interface module

2   comprises a Controller and View and the application program comprises a Model conforming

3   to the Model View Controller architecture.

1   40.   The article of manufacture of claim 39, wherein the Controller includes the

2   statements that are processed to generate output data, and wherein the Controller further

3   performs:

4   requesting ,the interaction object from the Model upon reaching the processing point;

5   and

6   transferring the received interaction object to the View, wherein the View generates the

7   output data to render from the interaction object.

1   41.   The article of manufacture of claim 40, wherein the output data generated by

2   the model includes questions, further comprising:

3   receiving, with the View, user input in response to the presented questions;

4   adding, with the View, the received user input to the interaction object including the

5   output data generated by the View; and

6   returning the interaction object including the received user input to the Model to

7   process.

1   42.   The article of manufacture of claim 41, wherein returning the interaction object

2   including the received user input to the Model further comprises:

3   transmitting, with the View, the interaction object including the answers to the

4   Controller; and

5   transferring, with the Controller, the Interaction Object including the received user input

6   to the Model.

1   43.   The article of manufacture of claim 37, wherein multiple user interface modules

2   are capable of generating output data from the interaction object, wherein each user interface

3   module generates the output data to render in a different format.

1   44.   The article of manufacture of claim 37, wherein each user interface module

2   generates the output data to render on a different type of output device.

1   45.   The article of manufacture of claim 37, further comprising:

2   continuing to generate, with the user interface module, output data in response to

3   processing statements in the user interface module after the output data generated from the

4   interaction object is rendered on the output device.

1   46.   An article of manufacture including code for generating a user interface, wherein

2   the code includes an application program that processes data and generates application output

3   and a user interface module that processes the application output to generate output data to

4   render on an output device by:

5   generating output data to render on the output device in response to processing

6   statements in the user interface module;

7   receiving an interaction object from the application program specifying data to generate

8   as output data;

9   generating output data to render on the output device from the interaction object from

10   the data specified in the interaction object;

11   receiving user input in response to the output data rendered on the output device from

12   the interaction object;

13   adding the received user input into the interaction object; and

14   returning the interaction object including the received user input to the application

15   program.

1   47.   The article of manufacture of claim 46, wherein the interaction object further

2   specifies attribute information, wherein the output data is rendered on the output device in a

3   format that corresponds to the specified attribute information.

1   48.   The article of manufacture of claim 46, wherein the interaction object comprises

2   a plurality of interactions, wherein each interaction includes data to cause the user interface

3   module to render a message or question on the output device.

1   49.   The article of manufacture of claim 48, wherein each interaction is capable of

2   providing information to cause the user interface module to generate a question that is a

3   member of a set of questions comprising:

4   a true false question;

5   an essay question; and

6   a multiple choice question.

1   50.   The article of manufacture of claim 48, wherein one or more interactions may

2 include data to cause the user interface module to render a multiple choice question by

3 providing:

4   a question string comprising a question presented to the user;

5   a choice array comprising a plurality of user selectable choices to present as responses

6 to the presented question, wherein the choices in the choice array are presented on the output

7 device with a selection mechanism to enable selection of at least one of the choices; and

8   a selection array indicating which user selectable choices were selected through the

9 selection mechanism, wherein the selection array comprises the received user input in response

10 to the presented question.

1   51.   The article of manufacture of claim 46, wherein the interaction including data to

2 cause the user interface module to render a multiple choice question further includes:

3   an allowable selection variable indicating a maximum number of user selectable choices

4 that may be indicated as selected in the selection array.

1   52.   The article of manufacture of claim 46, wherein the user interface module

2 comprises a Controller and View components and the application program comprises a Model

3 conforming to the Model View Controller architecture.

1   53.   The article of manufacture of claim 46, wherein multiple user interface modules

2 are capable of generating output data from the interaction object, wherein each user interface

3 module generates the output data to render in a different format.

1   54.   The article of manufacture of claim 53, wherein each user interface module

2   generates the output data from the interaction object to render on a different type of output

3   device.